IN THE SPECIFICATION

Please replace the Specification with the enclosed substitute Specification in accordance with 37 C.F.R. 1.121(b)(3). The substitute Specification contains no new matter and only includes the addition of headings and paragraph numbers in accordance with U.S. practice.

Express Mail Label No. EV727804589US

Substitute Specification

[0001] BATTERY TERMINAL

[0002] FIELD OF THE INVENTION

[0003] The invention relates to a battery terminal, in particular for an automobile battery having a higher voltage than, for example, 12 volts, comprising a terminal connector, which is located on a cable and which, when in use, engages on a battery pole in a non-positive and/or positive manner.

[0004] BACKGROUND

[0005] Such battery terminals are already known. An automobile battery having, for example, 24 or 42 volts can provide considerably higher power at the battery poles than a conventional 12 volt automobile battery. The higher voltage creates the danger of unconnected arcs to develop when the terminal connectors are being disconnected or arc-over voltage to jump to other metal components, which is dangerous for a mechanic and/or can cause fire hazards. This danger particularly arises when a bridging (jumper) cable is used to connect the automobile to another vehicle.

[0006] Thus, a main objective of the present invention is to provide a battery terminal and/or a contact arrangement or contact connector of the above type, in which disconnection and the connection of the battery terminal cannot result in external arcs or sparks and which also prevents or complicates the connection of a bridging cable.

[0007] SUMMARY

[0008] This object of the invention is attained by the terminal connector being substantially cup-shaped or bell-shaped in order to encompass the battery pole from

the top and from the sides. The exterior of the terminal connector is covered, at least at its surface, by a housing comprising an insulating material. The housing is provided with an interior opening which tapers or narrows in a direction opposite of its mounting direction. The terminal connector also/alternatively has a cross-section expanding in the mounting direction relative to the interior of the housing. Thus the housing can be moved axially relative to the terminal connector. The terminal connector axially exceeds the housing in the position of use, and in the disconnected position the exterior wall of the terminal connector is abutted by the interior wall of the housing. Thus the terminal connector is thereby compressed radially, its interior side pressed against the exterior side of the battery pole.

[0009] Advantageously, the bell-shaped terminal connector need only be displaced or pressed in the axial direction towards the battery pole, it subsequently being compressed in the same direction by the axial displacement of the housing, thus contacting the battery pole. Any arcs or sparks developing hereby or during disconnection are here located inside the insulated housing and are therefore harmless.

[0010] In order to facilitate compression of the housing compartment of the terminal connector, a diagonal surface of the interior opening of the housing is utilized. The diagonal surface is located in the housing's lower area and corresponds to a diagonal surface in the upper area of the exterior wall of the terminal connector. The diagonal surface at the interior wall of the housing abuts the diagonal surface at the exterior wall of the terminal connector when in the disconnected position.

[0011] It is particularly advantageous for an interior ring or partial ring, connected via bars to the interior side of the housing, to be provided inside the opening of the housing above the area narrowing upwards and/or away from the

entry into the opening. The ring has exterior dimensions identical to or smaller than the interior dimensions of the terminal connector when not deformed. Thus limits or hinders a radial compression of the terminal connector in the area of this interior ring in the connected or operational position of the terminal connector. During the axial adjustment of the housing in the disconnected position enables, supports or accelerates the radial expansion of the terminal connector into its original position.

[0012] Thus, the terminal connector can be urged into the connected or operational position by the housing from the outside and/or by the internal ring in the radial direction from the inside. When the housing is moved into the disconnected position, the interior and the exterior stresses of the terminal connector is reduced. This allows the components of the terminal connector adjusted radially inward or compressed to quickly move radially outward and thus away from the battery pole. Furthermore, the interior ring moves opposite the connecting direction of the terminal connectors inside the terminal connector and abuts it on the inside. This further reduces the development of arcs, which in general can only become a few millimeters in length at the present operational voltage, and which soon detach by the rapid increase of the distance of the charged and/or metal parts immediately after their development.

[0013] The housing can encompass and/or abut the terminal connector partially or in its entirety and can, for example, be embodied as an exterior ring, which cooperates with the interior ring connected thereto via bars.

[0014] The terminal connector can also be embodied such that the compressed components have smaller interior dimensions in the relaxed position than the exterior dimensions of the battery pole and that they are widened and/or pre-stressed in the disconnected position by the interior ring, and in the connected or

operational position the pre-stress is loosened by the interior ring and the terminal connector encompasses the battery pole by its inherent stress in a force-fitting manner and thus, is fixed by the exterior housing.

[0015] A preferred embodiment of the battery connector of the present invention comprises a terminal connector having at least two axially extending, at their exterior edge, open slits which at least partially axially divide the exterior wall at the terminal connector. Therefore, the material for the terminal connector can be comparatively hard and stable and, at the same time, the terminal connector can be flexible and radially compressible in the area encompassing the terminal connector in the battery pole by reducing the width of the slit. For instance, embodiments with three to six segments and/or slits are preferred for good stability of the terminal connector and at the same time good flexibility.

[0016] It is advantageous for one axially extending slit to be provided at the terminal connector in the area of each of the bars carrying the interior ring. For example, the slits separating the radially compressible segments, which divide the exterior wall of the terminal connector, can be extended upward to the extent that the bars carrying the interior ring can be guided through these slits, thus providing a way of fastening the interior ring to the interior side of the housing, while abutting the terminal connector at its exterior. Such an arrangement of the bars inside the slits of the terminal connector also prevents a distortion of the housing relative to the terminal connector.

[0017] In order to easily move the housing and the terminal connector easily from the detached position to the connected position, it is useful for a pivotally supported excentric cam to engage the housing, which by rotating beyond its idle point shifts the housing axially over the terminal connector and, thus, the terminal

connector itself into the clamping and connection position fixing it in the use position.

[0018] A preferred embodiment of the excentric cam comprises an operating lever, which pivots around an axis extending laterally to the shifting direction of the housing. Two pins are positioned eccentrically to the rotational axis of the operating lever and are arranged at the operating lever, engaging an oblong hole at the housing. On the one hand, by using the operating lever the excentric cam can easily be operated manually and, on the other hand, the position of the operating lever can be easily closed with respect to the actual position of the terminal connector. For example, in the operational position the operating lever can rest flat on the battery housing and be positioned upwardly in the disconnected position, so that particularly the accidental closing of the hood or a similar covering of the battery is not easily possible. The guidance of pins in an oblong hole can be practically employed without wear so that the terminal connector can be operated reliably for a long time.

[0019] It is advantageous for safely contacting the battery terminal connector when the excentric cam, serving to adjust the terminal connectors, maintains its own location in the contact position i.e., the operational position. This is possible by shifting the pins in the oblong hole relative to the rotational axis of the operational lever in the radial direction beyond the engaging point of the operational lever at the housing and, thus, into a stop or rest position.

[0020] To reliably keep potentially developing arcs on the inside of the housing and to protect the components surrounding the battery, it is preferred that the housing terminal connectors, in the connected position, encompass the housing laterally beyond the cable connection.

[0021] For a contact secured against vibrations or other dynamic stress between the terminal connector and the battery pole, it is preferred that the battery pole or a contact bushing encompassing it to be provided at their outer portion having at least one indentation, particularly at least one preferably circular groove, circumferential groove, or the like and the inside of the cup-shaped or bell-shaped terminal connector to be provided with a corresponding protrusion, which engages the indentation in the clamping position in a form-fitting manner. Alternatively, a protrusion can be provided at the battery pole and on the inside of the terminal connector a matching indentation for a form fitting connection in the axial direction. By the cooperation of the protrusion and the indentation an interlocking can be achieved of the terminal connector to the battery pole. The two components are fixed in the axial direction relative to one another, thus improving the electric connection in the operational position.

[0022] To prevent dropped metal parts, for example tools such as wrenches, from causing a short between the battery pole and the ground, or between the two battery poles, when one or both of the terminal connectors have been removed, it is useful for the upper end of the battery pole to carry a cap made from an insulating material, which also separates the area of the terminal connector located in the area above the interior ring from the battery pole.

[0023] To further protect and separate the battery pole laterally it is preferred that the battery pole be encompassed by a radially surrounding protective wall comprising an insulating material. This wall is distanced from the battery pole. In the operational position the housing fits into the radial distance between the protective wall and the battery pole and, thus is encompassed on its outside by the protective wall. This way, the housing can also be radially stabilized by the protective wall in the connected or operational position. By the combination of the housing, which in the connected or operational position separates the terminal

connector (and the battery pole positioned therein), and the protective wall around the housing, the terminal connector can be protected such that, for example, splashing water can be kept away.

[0024] In addition to the plastic cap, the battery pole can also be better protected from short circuits by dropped metal objects if the protective wall is axially dimensioned such that it is at least equivalent to the axial extension of the metal and current bearing parts of the battery pole.

[0025] The invention shall be better described hereafter with reference to some embodiments and examples, based upon the attached drawings, wherein corresponding elements are designated by similar reference numerals. In the drawings:

[0026] BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Fig. 1 is a partial cross-section front elevation view of a terminal connector according to the invention having a connector clamp, a housing encompassing the connector clamp, and an excentric cam in the disconnected position,

[0028] Fig. 2 depicts the terminal connector of Fig. 1 in the operational position,

[0029] Fig. 3 is a perspective view of a terminal connector of the present invention,

[0030] Fig. 4 is a perspective view of a housing of the present invention,

[0031] Fig. 5 is a perspective view of the excentric cam of the present invention, and

[0032] Fig. 6 depicts the terminal connector to Fig. 1 in the operational position having a protective wall encircling the battery pole and the housing.

[0033] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] A battery terminal, collectively indicated by reference numeral 1, is provided with a terminal connector 4, which engages a battery pole 5 in a force fitting and/or form fitting manner. The individual terminal connector 4, shown in Fig. 3, is here embodied as substantially cup-shaped or bell-shaped in order to encompass the battery pole 5 and comprises, the connecting direction according to arrow Pf1, an increasing cross-section in its lower opening.

[0035] As shown in Figs. 1 and 2, the terminal connector 4 is encompassed by a housing 6 made of an insulating material. The housing 6 has an opening tapering or narrowing from its lower area in the opposite direction of the connecting direction (arrow Pf1) and can be axially moved relative to the terminal connector 4, as can be seen when comparing Figs. 1 and 2.

[0036] In the disconnected position (Fig. 1) the terminal connector 4 axially extends beyond the housing 6, while in the operational position (Fig. 2) the exterior wall of the terminal connector 4 is abutted by the interior wall of the housing 6. Thus the terminal connector 4 is radially compressed and its interior side and/or interior wall is pressed against the exterior side of the battery pole 5.

[0037] In order for the housing 6 to be easily moved relative to the terminal connector 4 during transition from the disconnected position into the operational position of the battery terminal 1 and to keep the wear low during the abutting of

the exterior wall of the connector terminal 4 by the interior wall of the housing 6 moving downward, the interior narrowing opening of the housing 6 is provided with a diagonal surface 7. This diagonal surface 7 comprises a lower section which is approximately equivalent to the upper section of a diagonal surface 8 at the exterior wall of the terminal connector 4 expanding radially outward. The two diagonal surfaces 7 and 8 are contacting one another in the disconnected position, as shown in Fig. 1. When the housing 6, and, with it diagonal surface 7, shown in the connected or operational position in Fig. 2 are moved according to arrow Pf1, the terminal connector 4 is compressed by the narrowing interior wall of the housing 6 above the diagonal surface 7.

[0038] Fig. 4 particularly clearly shows an interior ring 9 is connected via bars 10 to the interior wall of the housing 6, within the opening and above the narrowing section opposite the connecting direction according to arrow Pf1 and/or the diagonal surface 7. Figs. 1 and 2 show that the exterior dimensions of the interior ring 9 are slightly smaller or approximately identical to the interior dimensions of the non-deformed terminal connector 4. Thus, in the operational position (Fig. 2), the interior ring 9 limits any radial compression of the terminal connector 4 in the upper area, where the interior ring is located. This causes or supports and/or speeds the radial expansion of the terminal connector 4 during the axial adjustment of the housing 6 from the connected or operational position to the disconnected position, because the interior ring 9, mounted to the housing 6, is moved upwards and the interior wall of the terminal connector 4 is abutted, and thus pressed outward.

[0039] Fig. 3 shows the terminal connector 4 provided with several axially extending slits 11, which are open at the lower periphery of the terminal connector 4 and which divide the exterior wall of the terminal connector 4 axially into radially compressible segments 12. In an exemplary embodiment shown in Fig. 3, six slits

11, equally distributed over the circumference of the terminal connector 4, divide the exterior wall of the terminal connector 4 into six equally sized segments 12. The segments 12 can be compressed under a reduction of the width of the slits, which are arranged above the area expanding radially outward in the non-slit exterior wall of the terminal connector 4. The slits 11 extend upwardly to such an extent that each of the slits 11 can engage one of the bars 10 which hold the interior ring 9. This is shown in Figs. 1, 2, and 6 by the dashed line representation of the terminal connector 4 in the area of the interior ring 9, since the cut terminal connector 4 is hidden by the bars 10.

[0040] In Figs. 1 and 2 an excentric cam 13 is also shown, which engages housing 6 and which displaces the housing axially beyond the terminal connector 4 downward by pivoting beyond the idle point, and fixing it in the connected or operational position.

[0041] In Fig. 5, the embodiment of the excentric cam 13, shown in Figs. 1 and 2, is represented in greater detail. Excentric cam 13 is provided with an operational lever 14, which is pivotally supported around an axis 15 extending lateral to the displacement direction of the housing 6. Operational lever 14 comprises two pins 16, eccentrically supported relative to the rotational axis 15 of the operational lever 14, which engage an oblong hole 17 of the housing 6, as shown in Figs. 1 and 2. By the movement inside the oblong hole 17 of the housing 6, the lever 14 can be axially adjusted in reference to the terminal connector 4. In the partial cross-section representations in Figs. 1, 2, and 6, an area of the housing 6 which forms the oblong hole 17 is not cross-sectioned. By the dashed line representation it is shown that one pin 16 each engages from the exterior into the corresponding oblong hole 17 thus encompassing the housing 6 and the terminal connector 4 arranged therein.

[0042] The excentric cam 13 maintains its operational position shown in Fig. 2, because the pins 16 are held in the oblong hole 17 extending laterally to the movement direction of the housing 6. During the movement of the operational lever 14 from the disconnected position into the connected or operational position it is displaced beyond the oblong hole 17 in the radial direction via the rotational axis 15 of the operational lever 14 and/or its engagement point 22 at the housing 6.Thus, any displacement of the pins 16 inside the oblong hole 17 back in the direction of the disconnected position through any axial forces is impossible.

[0043] In Fig. 2 it is shown that the housing 6 encompasses the terminal connector 4 in the connected or operational position beyond its cable connection. The housing 6 comprising an insulating material and/or provided with insulation at its surface thus can protect the terminal connector 4 from any contact with metal objects and/or hands.

[0044] Figs. 1 and 2 show that at its exterior the battery pole 5 is provided with indentations 18, in the embodiment shown they are several narrow circumferential grooves, axially located in close proximity to one another. Several matching protrusions 19 are also provided at the terminal connector 4, arranged about its interior wall, which in the connected or operational position, engage the indentations 18 in a form-fitting manner and in this engaged position the connection between the terminal connector 4 and the battery pole 5 is protected from dynamic stress, such as for example vibrations, and also improves the electric connection.

[0045] In an embodiment shown in Fig. 6, the battery pole 5 is radially encircled by a protective wall 21 made from an insulating material, which is radially distanced from the battery pole 5 to such an extent that in the connected or operational position, the housing 6 fits into said radial distance between the battery

pole 5 and the protective wall 21, and thus, encompasses the exterior by the protective wall 21. The protective wall 21 is axially dimensioned such that it is slightly higher in the axial direction than the metal and/or current bearing parts of the battery pole 5. Together with a cap, optionally mounted on the battery pole 5 made from an insulating material, the protective wall 21 can protect the battery pole 5 effectively from any contact or short circuit by dropped metal objects, such as for example tools. In the connected or operational position, the protective wall 21 radially encompassing the housing 6, can stabilize the housing 6.